

Interactive comment on “Observations of oxidation products above a forest imply biogenic emissions of very reactive compounds” by R. Holzinger et al.

R. Holzinger et al.

Received and published: 7 October 2004

We sincerely thank the reviewers for their effort in reviewing our manuscript, and appreciate several of the insights they provided. The referee raised several specific issues, which we respond to in order below:

We share the referee’s perception of forest thinning. However, we do not see the need to change or rephrase because we are not extensively arguing or using results from the forest thinning experiment in order to give credibility to our results.

The referee raises the question of artifacts in connection with collected aerosols on the teflon-filters, day/night temperature swings, and UV-radiation. For the following reasons we are confident that we did not encounter problems of this kind:

[Full Screen / Esc](#)

[Print Version](#)

[Interactive Discussion](#)

[Discussion Paper](#)

→ Certainly the 2 inlets above the forest canopy received significantly more UV radiation than the 2 inlets within the canopy which were partly shaded. Accordingly we would expect higher concentrations at the top-level if there were such problems. Similarly we argue for temperature swings: the 5th, and lowest inlet was located one meter off the ground, in a more open spot. We suspect that this got hottest on warm summer days. However, the highest concentrations of oxidation products were not sampled from that inlet.

→ The teflon-filters on the gradient inlets (lower flow, 1 L/min) were replaced every 3-6 weeks. Usually no blackening was observed on used filters, and we did not see changes in the signal of the oxidation products after changing the filters.

→ The filter on the inlet used for eddy-covariance flux measurements at the top of the tower (higher flow, 10 L/min) was replaced every other week and was always blackened by dust and other particles when it was changed. In September 2003 we started dividing the sample time between the 2 inlets (one gradient inlet and one eddy-covariance flux inlet) at 12.5m and we did not see concentration differences between these two inlets with different flow rates and thus different particulate loading at the same height-level.

The referee correctly argues that the vertical profile of the oxidation products suggests either fast dry deposition and/or HO-reactions as a source of these compounds. We also consider dry deposition to be a likely loss mechanism for the observed oxidation products; and we'll thankfully comply with the referee's request to address this in a revised version of the paper. Although we discussed that estimated HO levels above the canopy are too low to cause observed levels of oxidation products (p5354, line 26 - p5355, line2), HO-reactions certainly contribute to the short lifetime of unmeasured precursor compounds. Furthermore, according to Paulson et al (1999) reactions of ozone with alkenes produce HO-radicals. In this way HO reactions can play a more significant role by amplifying the ozone initiated degradation process. We will add this discussion to the final version of the paper.

Interactive
Comment

A loss of $20\mu\text{mol ozone/m}^2/\text{h}$ due to reactions with terpenes in the forest canopy is consistent with aerosol measurements at the site. During summer days growth events have been frequently observed. The aerosol growth data will be thoroughly addressed in a paper whose first author (M. Lunden) is not involved in our current manuscript, thus we will not include the details of her analysis here.

Our work complements previous work on unaccounted (chemical) ozone deposition by Kurpius and Goldstein (2003). However, we want to stress the fact that our paper is not focused on ozone deposition and that we have derived our results without any assumptions concerning ozone flux or its partitioning. This work opens a completely new window on previously unaccounted chemistry within the forest canopy. The referee's general criticism on favoring ozone plus terpene reactions as an explanation of observed ozone deposition deserves further discussion in another venue, but it is not directly related to the manuscript under review.

Interactive comment on Atmos. Chem. Phys. Discuss., 4, 5345, 2004.

[Full Screen / Esc](#)[Print Version](#)[Interactive Discussion](#)[Discussion Paper](#)